PATENT

PEARNE & GORDON LLP
526 Superior Avenue, East
Suite 1200
Cleveland Ohio 44114-1484
(216) 579-1700

Attorney Docket No. 33109

Assistant Commissioner for Patents
Box PATENT APPLICATION
Washington, D.C. 20231

Sir/Madam:

Transmitted herewith for filing by other than a small entity is the patent application of:

Inventor: Andi Vonlanthen

For: VERFAHREN ZUR STEUERUNG DES DYNAMIKBEREICHES EINES HORGERATES SOWIE VERFAHREN ZUR FERTIGUNG VON HORGERATETYPEN UND HORGERAT

1 sheet of informal drawings is included.

An assignment of the invention to Phonak AG will be forwarded.

"Express Mail" mailing label number 635960044US

Date of Deposit 11/3/00

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Janet Morrison
Printed Name of Person Mailing Paper or Fee

Janet Morrison
Signature of Person Mailing Paper or Fee

CLAIMS AS FILED

For	Number		Rate	Fees
Total claims in excess of 20:	0	×	$18.00	$0.00
Independent claims in excess of 3:	0	×	$80.00	$0.00
Multiple dependent claims, if any, add surcharge of $270.00:				$0.00
Non English Specification, add surcharge of $130.00:				$130.00
			Basic Fee	$710.00
			TOTAL FILING FEE	$840.00
Assignment Recordal Fee of $40.00				$0.00
			TOTAL FEE	**$840.00**

A check in the amount of the Total Fee calculated above is enclosed.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§1.16 and 1.17 which may be required during the entire pendency of this application, or to credit any overpayment, to Deposit Account No. 16-0820, Order No. 33109.

Respectfully,

PEARNE & GORDON LLP

Jeffrey J. Sopko, Reg. No. 27676

Date:

0400

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Andi Vonlanthen

Serial No.: 09/706,188

Filed: November 3, 2000

Title: "A METHOD FOR CONTROLLING THE DYNAMIC RANGE OF A HEARING AID, AND METHOD TO MANUFACTURE DIFFERENT HEARING AIDS, AND A HEARING AID

Docket No.: 33109

LETTER

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Enclosed is a translation and a "Certification of Translation" of the above-identified application. The $130.00 fee for filing a non-English specification was included with the filing fee sent on November 13, 2000. Please enter this translation in the record of the above application.

If there are any additional fees resulting from this communication, please charge all uncovered fees to our Deposit Account No. 16-0820, our Order No. 33109.

Respectfully submitted,
PEARNE & GORDON LLP

By _____
Michael W. Garvey, Reg. No. 35878

526 Superior Avenue East, Suite 1200
Cleveland, Ohio 44114-1484
(216) 579-1700
Date: December 7, 2000

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on the date indicated below.

Michael W. Garvey
Name of Attorney for Applicant(s)

12-07-2000 _____
Date Signature of Attorney

GFE TRANSLATION Co., Est'd 1971

HARRY JULICH, ENGINEER
6807 WINTER LANE
ANNANDALE, VA 22003
PHONE: (703) 354-0491
FAX: (703) 354-2269

CERTIFICATION

I, the undersigned, am a professional translator, fully competent to translate from German into English, and I declare hereby that the attached English rendition,

A METHOD FOR CONTROLLING THE DYNAMIC RANGE OF A HEARING AID, AND METHOD TO MANUFACTURE DIFFERENT HEARING AIDS, AND A HEARING AID

is a genuine translation, accurate in every particular, to the best of my ability and knowledge, of the German text, also attached,

Verfahren zur Steuerung des Dynamikbereiches eines Hörgerätes sowie Verfahren zur Fertigung von Hörgerätetypen und Hörgerät.

November 9, 2000

H. Julich

Harry Julich

METHOD FOR CONTROLLING THE DYNAMIC RANGE OF A HEARING AID, AND METHOD TO MANUFACTURE DIFFERENT HEARING AIDS, AND A HEARING AID.

The present invention relates to a method for controlling the dynamic range defined in the preamble of claim 1, a method for manufacturing different kinds of hearing aids exhibiting different transfer functions as defined in the preamble of claim 6, further a hearing aid fitted with at least one acoustic/electric input transducer defined in the preamble of claim 7 and also an electromechanical transducer defined in the preamble of claim 12.

Typical hearing aids comprise at least one acoustic/electric input transducer followed by a signal processing unit of which the output drives an electric/mechanical transducer. As regards digital hearing aids, the signal processing unit is correspondingly digital and comprises an input-side analog/digital converter and as called for an output-side digital/analog converter. This is the case both for in-ear hearing aids and behind-the-ear hearing aids, the output-side electric/mechanical transducer usually being in the form of a loudspeaker unit fitted with a drive coil, but it applies also to implant hearing aids (cochlea implant) of which the output-side electric/mechanical transducer is fitted with a mechanical drive element.

The objective of the present invention is to make it possible for such a hearing aid -- where the term also definitely includes ear phones and hearing accessories for hearing-impaired individuals -- to adjust the particular appropriate dynamic range using the simplest means. To that end the initially cited control method is characterized in that the input impedance of the acoustic/mechanical transducer is selective switched.

Accordingly the invention is based on the insight that the dynamic range set at a hearing aid of the cited kind, depends also in significant manner on the input impedance of the electric/mechanical transducer. Simply by switching this input impedance to different impedance values, the said dynamic range then can be selected in very easy manner. As regards hearing accessories, the dynamic range can be changed according to the hearing

impairment to be remedied or, depending on locale, it may be changed according to the perceived acoustic environment, or, with respect to ear phones, according to the requirements at the time.

Selective switching of the input impedance can be implemented in a preferred embodiment of the method of the invention when fitting the hearing aid, in particular the hearing accessory, for instance by the audiologist, in order to attain a desired dynamic range.

In addition to or instead of the selective input-impedance switching during hearing-aid fitting, the invention proposes that the switching be carried out by means of the signal processing unit, that is in adaptation to the particular acoustic environment.

Moreover the switching of the input impedance may be carried out automatically as mentioned above by means of signal processing, and/or it may be initiated outside the hearing aid, whether manually at the hearing aid itself, in particular as regards an ear phone or an outside-the-ear hearing accessory, for instance by remote control, if called for and preferably in combination with a remote control driving the signal processing unit.

The concept of the invention also makes it possible to manufacture various kinds of hearing accessories in more economical manner than when a particular model-specific dynamic zone must be implemented per se in terms of hardware and software for each particular model. According the above-cited manufacturing process, this goal of the invention is attained in that the various hearing-aid models exhibit the same design and in that the dynamic range specific to a given model is set by selectively switching the input impedance of the electric/mechanical transducer. In this way the manufacture of various hearing-aid models can be focused on the manufacture of a single basic model of a hearing aid, and to select thereupon by means of the switching of the invention the particular required dynamic range.

The above technical problem can be solved concretely by a hearing aid of the invention defined in claim 7 and including preferred embodiment variations defined in claims 8 through 11.

Claim 12 moreover proposes an electro-mechanical transducer for a hearing aid with integrated means to carry out the method of the invention. In this manner the invention offers a transducer module allowing simple manufacture and which can be integrated directly, so that additional and considerable assembly steps can be avoided in the manufacture of the hearing aid.

The invention is illustratively elucidated below in relation to the attached Figures.

Fig. 1 is a simplified functional-block and signal-flow diagram showing the principle of the method or of a hearing aid of the invention with an integrated transducer of the invention,

Fig. 2 schematically shows an electric/mechanical transducer unit of the invention in the form of a loudspeaker module and fitted with an inductive source to carry out the control method of the invention, and

Fig. 3 schematically shows various ways of implementing the input-impedance control of the invention.

As shown in Fig. 1, a hearing aid, for instance an ear phone or -- and in particular -- a behind-the-ear or in-ear hearing accessory, though also a cochlear implant, comprises an input-side acoustic/electric transducer followed by a signal processing unit 3 which in the case of a digital hearing aid shall be a digital processor unit. An electric/mechanical transducer 5 is present at the output side of the signal processing unit 3.

As schematically indicated in Fig. 1, the transducer unit 5 includes the actual mechanical/electric transducer 5a exhibiting an impedance "e" at the input E5 of the transducer unit 5. In the invention, the input impedance e of the transducer 5a can be switched, by the switch 7 driven by means of a control input S, to various impedances e1, e2... in the manner schematically shown in Fig. 1. As shown in dashed lines in Fig. 1, the invention provides

switches which by means of a control input S allow switching the input impedance e of the output-side electric/mechanical transducer to given, previously selected impedances.

As shown in Fig. 3, the control of input-impedance switching basically can be carried out manually, whether by direct local action Loc on a switching element or by a remote drive Rem, in particular using remote control anyway present to drive the signal processing unit. The particular selective control of the input impedance e of the electric/mechanical transducer lower -- possibly in combination with manual control -- also can be automatically initiated by the signal processing unit 3 as shown in Fig. 1. In this manner and in practically adaptive manner, the dynamic range of the hearing aid can be made to automatically follow the switched-on operational mode at the processing unit and moreover practically as a function of the acoustic environment.

Depending on the design of the mechanical/electric transducer, in particular of its discrete impedance elements determining the input impedance, the switch 7 can be a separate and independent unit integrated between the output of the signal processing unit 3 and the input of said transducer. Preferably, and as also shown in Fig. 2, such a switch shall be integrated into a modular, electric/mechanical transducer 15.

Fig. 2 schematically shows an electric/mechanical transducer 17 conventionally used in such a transducer module 15 of hearing aids and in the form of a loudspeaker fitted with an inductive drive 19. Illustratively the drive 19 comprises two coils 19a, 19b. These coils 19a, 19b and connected either in series or parallel by the switch 17 and as a result the input impedance of the module 15 which is determined at least in part by said coils shall be switched. Obviously more than two states of input impedance may be easily attained in selectively switched manner, namely by selectively connecting the discrete impedances provided either in parallel or in series circuits and thus to implement the particular desired input impedance.

As regards a hearing accessory, any requiring fitting, in particular of the transfer function of the signal processing unit by the audiologist to the particular individual requirements, is carried out by initially switching ON the particular desired input impedance. Such a switching configuration can then be retained until there is a need for modification, again carried out by an expert such as the audiologist, or, if based on the initial setting, it may be carried out automatically or manually by the wearer switching the input impedance while using the hearing aid. By providing a reset feature, for instance by manually actuating the signal processing unit. a preferred option is attained, namely to reset the cited input impedance anytime to the expert's initial setting.

On one hand the method of the invention allows switching the hearing-aid dynamic range using the very simplest means, and on the other hand , as regards the manufacture of hearing aids differing only by their dynamic ranges, to manufacture them simultaneously and to freeze the class of model only after manufacture proper by selecting said input impedance and hence the dynamic range, and possibly only by fitting by an expert such as said audiologist.

CLAIMS

1. A method to control the dynamic range of a hearing aid, comprising at least one acoustic/electric input transducer followed by a signal processing unit which in turn is operationally connected to an electric/acoustic transducer,

characterized in that

the input impedance of the acoustic/electric transducer is selectively switched from one value to another.

2. Method as claimed in claim 1, characterized in that selective switching is carried out when matching the hearing aid to an individual.

3. Method defined in claim 1, characterized in that said switching is controlled by the signal processing unit.

4. Method as claimed in one of claims 1 through 3, characterized in that the switching is carried out automatically or is initiated from outside the hearing aid.

5. Method as claimed in one of claims 1 through 4, characterized in that the input impedance is switched by selectively switching between series and/or parallel circuits of impedance elements.

6. A method for manufacturing hearing-aid models with different transfer functions between input-side acoustic/electric transducers and at least one output-side electric/mechanical transducer,

characterized in that

the hearing-models are manufactured having the same design and in that their impedance-specific dynamic range is set by selectively switching ON an input impedance of the electric/mechanical transducer.

7. A hearing aid fitted with at least one acoustic/electric input transducer of which the output is operationally connected to the input to of a signal processing unit of which the output is operationally connected to the input of at least one electric/mechanical transducer.

characterized in that

the input impedance of the transducer can be switched at a control input.

8. Hearing aid as claimed in claim 7, characterized in that the control input is operationally connected to an output of the signal processing unit.

9. Hearing aid as claimed in either of claims 7 and 8, characterized in that the control input is operationally connected with a manually driven control unit.

10. Hearing aid as claimed in either of claims 7 and 8, characterized by a switch connecting at least two impedance elements selectively in series or parallel to the control input.

11. Hearing aid as claimed in either of claims 9 and 10, characterized in that the impedance elements at least in part are coils.

12. An electromagnetic transducer for a hearing aid fitted with at least two impedance elements,

characterized in that

a switch is present at the transducer and comprises a control input setting the particular operational input impedance by configuring the impedance elements in different ways..